

## Sheet 9 Physics.

$$1) \quad P = \frac{2}{R} \gamma \quad \gamma = 0.04 \text{ N/m} \quad R = 0.05 \text{ m}$$

$$P = \frac{2}{R} \gamma = 1.6 \text{ N/m}^2 = 1.6 \text{ Pa.}$$

$$2) \quad \text{volume of a sphere is} = \frac{4}{3} \pi R^3$$

$$V = 2.5 \text{ litres}$$

$$\text{volume of one alveoli} = \frac{2.5}{3 \times 10^8} =$$

$$8.33 \times 10^{-9} \text{ L each.}$$

$$1 \text{ litre} = 0.001 \text{ m}^3$$

$$\text{So volume} = 8.33 \times 10^{-12} \text{ m}^3$$

$$8.33 \times 10^{-12} = \frac{4}{3} \pi R^3$$

$$R = 1.257 \times 10^{-4}$$

$$P = \frac{2}{R} \gamma \quad P = 397.55 \text{ Pa.}$$

3)

$$h = \frac{2\gamma}{\rho r g} = \frac{2\gamma}{\rho r g} \Rightarrow \text{Capillary action.}$$

$$\text{density } \rho \text{ of water} = 1000 \text{ kg/m}^3$$

$$g \Rightarrow \text{gravity} \quad r \Rightarrow \text{radius}$$

$$h = \frac{2 \times 0.072}{1000 \times \frac{0.5 \times 10^{-4}}{2} \times 9.81} = 58.73 \times 10^3 \text{ m}$$

4.

Work =  $P \Delta V$  = Pressure  $\times$  Volume.

$$80 \text{ mL} \Rightarrow 8 \times 10^{-5} \text{ m}^3 \quad 120 \text{ mmHg} \Rightarrow 16 \times 10^3 \text{ Pa}$$

$$25 \text{ mmHg} \Rightarrow 3.33 \times 10^3 \text{ Pa}$$

$$\text{Work done during systole} = 16 \times 10^3 \times 8 \times 10^{-5} = 1.28 \text{ Nm.}$$

$$\text{Work done during pulmonary phase} = 3.33 \times 10^3 \times 8 \times 10^{-5} = 0.266 \text{ Nm}$$

$$\text{Total work done} = 1.546 \text{ Nm}$$

per pump.

$$72 \text{ pump} \quad 1 \text{ min}$$

$$72 \times 60 \times 24 \text{ pump} \quad 1 \text{ day}$$

$$103680 \text{ pump}$$

$$\text{Total work done daily} = 160.345 \times 10^3 \text{ Nm.}$$

5)  $K.E = P \times V$

$$\text{max } P = 3.33 \times 10^3 \text{ Pa} \quad \text{Volume} = 8 \times 10^{-5} \text{ m}^3$$

$$= 0.266 \text{ Nm}$$

6)

Typical Artery

$$\text{Tension} = P \times \text{Radius}$$

$$159.98$$

$$59.99$$

Small Capillary

$$0.0239 = 23.99 \times 10^{-3}$$

Small Vein

$$0.399$$

Vena Cava

$$19.99$$

8)

$$U_1 d_1^2 = U_2 d_2^2$$

$$\text{Speed}_1 \times \text{diameter}_1^2 = \text{Speed}_2 \times \text{diameter}_2^2$$

$$V \times (0.03)^2 = 50 \times (0.02)^2$$

b) yes at constricted area.

$$V = 112.5 \text{ cm/s}$$

9) ??

$$10) U_2 = \frac{A_1 U_1}{A_2} = \frac{2.5 \times 10^{-5} \cdot V_1}{1 \times 10^{-8}}$$

$$P = \frac{F}{A} = \frac{2}{2.5 \times 10^{-5}} = 80 \times 10^3 \text{ Pa.}$$

$$P = \frac{1}{2} \rho V^2$$

 $\rho = 1000 = \text{density of water.}$ 

$$80 \times 10^3 = \frac{1}{2} \times 1000 \times V^2 \quad V = 12.65 \text{ during barrel stage}$$

$$V_2 = \frac{2.5 \times 10^{-5} \cdot 12.65}{1 \times 10^{-8}} = 31.62 \times 10^3 \text{ m/s}$$

$$11) P_1 - P_2 = \rho g h$$

$$\text{Pressure of air} = \frac{1}{2} \rho V^2 = \frac{1}{2} \times 1.25 V^2 = 0.625 V^2$$

$$0.625 V^2 - P_{\text{atm}} = 13600 \times 9 \times \frac{5}{100} \quad V = 415.68$$

$$101325 \text{ Pa}$$

12) needs lecture

13) by 29.289%

14)

→ needs lecture

15)

16) a)  $\gamma = \frac{F}{2\pi \times 2r} = \frac{F}{4\pi r}$

b)  $\gamma = \frac{8.40 \times 10^{-3}}{4 \times \pi \times \frac{2.8}{100}} = 0.0238 \text{ N/m}$

17)

$$A_1 V_1 = A_2 V_2 + A_3 V_3 + \dots + A_n V_n$$

~~$\pi (1.2)^2 \times 40 = X ((4 \times 10^{-4})^2 (5 \times 10^{-4}) \cdot \pi)$~~

$$X = 288 \times 10^6 = 288 \text{ million.}$$

18)  $A_1 V_1 = A_2 V_2$

$$30 \times 3 = 600 \times V \quad V = 0.15 \text{ at capillaries.}$$

$$600 \times 0.15 = 5 \times A \quad A = 18 \text{ at venacava.}$$